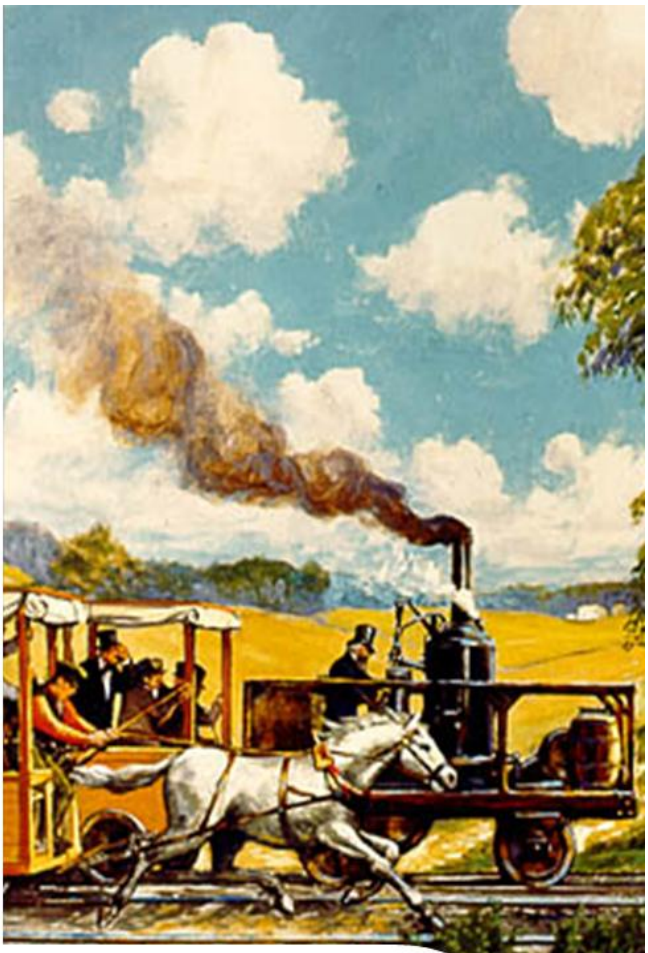
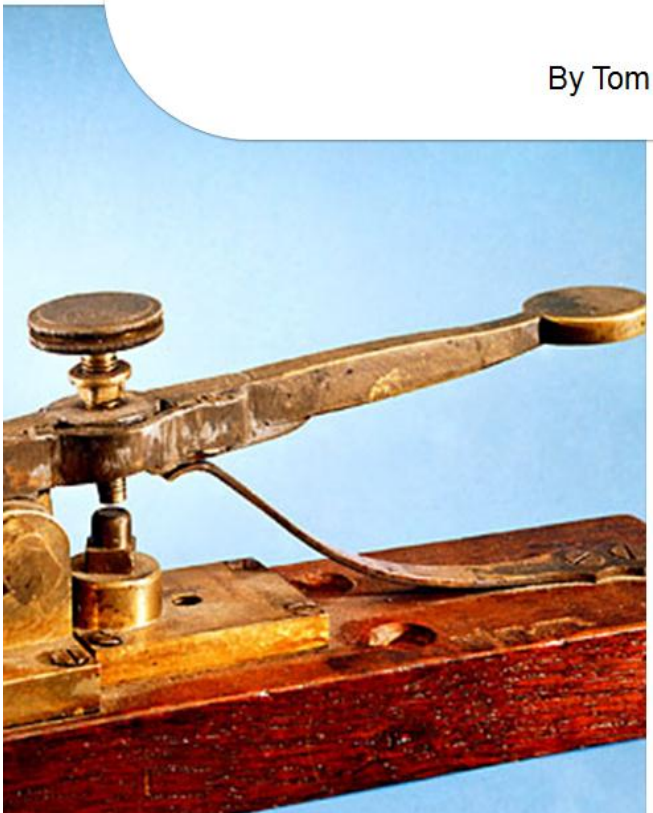
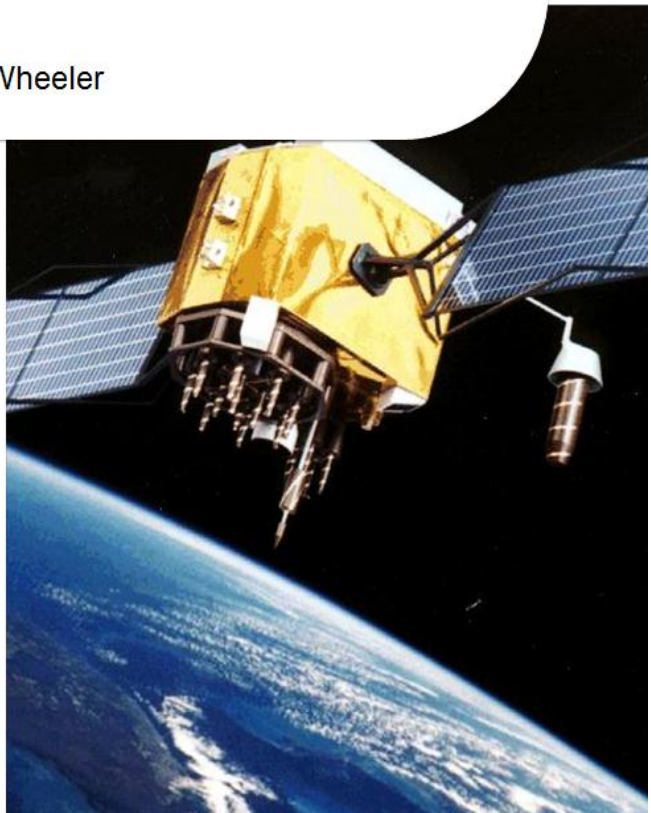


NET EFFECTS
The Past, Present, and Future Impact of Our Networks

By Tom Wheeler





Introduction

Throughout my professional life I have been involved with the introduction of new technologies. And though my day job was to chase the future, history has been an abiding hobby. One of the ways I have tried to understand what lies beyond the next hill in the landscape of the communications revolution is to study the advent of similar periods in the past.

Over the last several years I have been investigating the network revolutions of history. I called the project "From Gutenberg to Google: The History of Our Future." The goal was to assemble the work into a book. When President Obama nominated me to be Chairman of the Federal Communications Commission (FCC) the project was put on hold. Nevertheless, this review has taught me a lot about the present realities of our changing network environment.

I've always been a "network guy." My professional career has been intimately engaged with the cable, wireless, and digital industries. Reading history has reinforced the central importance networks play and revealed the common themes in successive periods of network-driven change. Now I find my FCC colleagues and myself in a position of both responsibility and authority over how the public is affected by and interfaces with the networks that connect us. What follows is an attempt to synthesize some of that research — and the stories discovered along the way — to present an historically-informed underpinning for decision making. The thoughts contained herein, of course, are mine alone.

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November 26, 2013

NET EFFECTS

Human beings, and the civilizations they have created, have always been defined by networks. Looking back over the long rhythms of history, it is possible to observe how each broad epoch of the human saga has been defined by the way its inhabitants connect and communicate. From the economic patterns of production and consumption to the social patterns of everyday life, how we connect has defined who we are.[*]

From the birth of civilization until the middle ages, human beings were dominated by the oral tradition and the constraints of animal-powered communication. Priestly classes controlled what was known and local hierarchies defined and controlled individual ambition.

Gutenberg's innovation in printing unleashed an explosion of information and communication such as the world had never seen. The spread of knowledge that resulted destabilized the world as Gutenberg's contemporaries knew it.

The next great network revolution was in the mid-19th Century. The birth of the railroad accelerated communication to a speed that was inconceivable before the perfection of the

[*] Early networks were built around nature; rivers, mountains, even continents shaped the patterns of primitive cultures, the road networks of ancient empires, and the coastal transport of early traders. The network revolutions discussed herein were technology-driven. While it is possible to consider everything from a writing stylus to the wheel as some form of "technology," the concept herein is of "technology-based networks" – *i.e.,* those enabled by mechanical (or electronic) capabilities.

steam locomotive. The forces of geography that had previously constrained human enterprise succumbed to steam rolling on steel.

Contemporary to the railroad revolution was another equally important and destabilizing innovation that would further extend humanity's reach. First with the telegraph and, then, later with telephony, instantaneous communication across great distances led not only to the ultimate collapse of distance but also enabled the management of large-scale, far-flung systems. The modern corporation could not exist without it.

The same concept of information as signals was harnessed to deliver sound and video. By reaching Americans on a point-to-multipoint basis broadcasting overcame the one-off inefficiency of previous point-to-point systems. Connecting the nation's homes, offices and automobiles, over-the-air services created a national platform for shared American experiences.

Over the last several decades, the fourth revolution, digital communication, has both contributed to the size and scale of organizations (including network providers) as well as begun to re-empower small economic units to take on the behemoths. One of the signal achievements of this latest great information revolution – our network revolution – is how the results of its diffused control and increased autonomy produce "innovation without permission."

It should come as no surprise, therefore, that as the new digital networks of today reshape the legacy of earlier networks, they upend the comfortable consistency into which our society had settled.

It has been suggested that we are living through the greatest network revolution in history. On this the jury is still out. The reverse telescope of history makes prior experiences seem much smaller than they were. Each of the preceding changes enabled by print, transportation and electronic communication were destabilizing and redefining. We should expect nothing less today.

What is clear about our network revolution, however, is that the new information networks *are* the new economy. Whereas earlier networks *enabled* the economic activities of their eras, our network revolution *defines* virtually all aspects of the current economy. In the process, it places even greater importance on the role Congress has given the FCC to protect, "the public interest, convenience, and necessity" of the nation's networks. We are at a crossroads in the evolution of digital networks. The FCC must play the crucial role of facilitating more dynamic, world-leading change to ensure that the gains of the last several decades are dwarfed by the wonders of the years to come. At the same time, the Commission must also safeguard, nurture and project into the future the enduring civic values that networks have historically embodied.

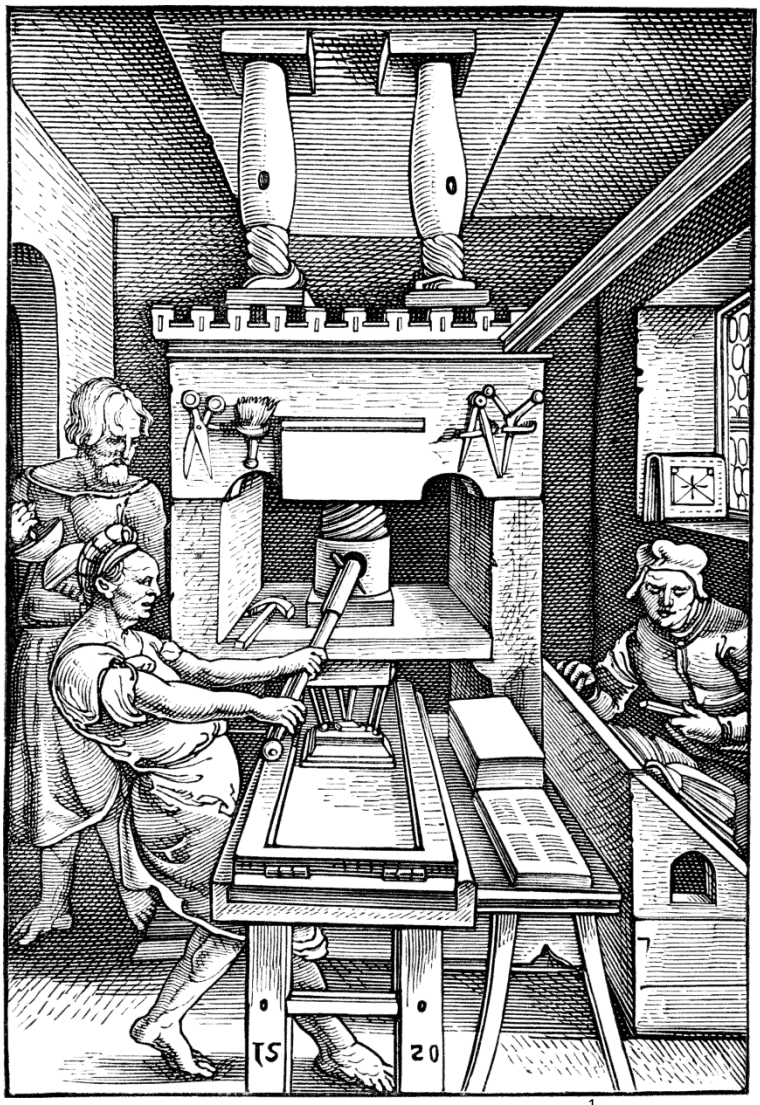
Three Effects of Our New Networks

History has taught us that the power of the network has never been the network itself, but what those connections enable. It is the *effects* of networks that redefine economies and reshape individual lives. Network technology is on a self-imposed path of continual advancement and acceleration. How the public interest deals with those developments is similarly a work in progress. Only when that process plays out will we have the verdict as to whether ours is, in fact, the greatest network revolution.

We can be certain of three effects of our new networks. The first is the end of the tyranny of place. Another is the continual acceleration of the velocity at which the information is utilized and transmitted. The third is a directional reversal from older networks, which because their activity was done at a central point, acted as a centripetal force on those using the networks, to today's networks that act as a centrifugal force because their network functions are "at the edge."

<u>Effect #1: The End of the Tyranny of Place</u>

From the earliest days when our ancestors painted on cave walls, the consumption of information had required the user to come to it. [†] Until the 15th century hard copy information was a rarity, controlled by the priestly and the powerful. When Johann Gutenberg picked the lock that had kept information confined the result was the original Information Revolution. The network of printers that sprung up in 15th and 16th century Europe fed the free-flow of information and ideas that started us on the track to today.



Example of a printing press, circa 1520.[1]

[†] A very few exceptions relied on sound or sight to move information. Drum signals, smoke signals, or the flashing of light could all send information over a distance, but for one reason or another were all constrained in their ability to do so.

While the printing revolution enabled widespread adoption of the Scientific Method's use of hypothesis and debate as the core mechanism of intellectual advancement, its information distribution was limited by the reality that consumption of the material still required the user to come to it. Books were more plentiful and less expensive than ever, and their information was portable and persistent; but it was still a unidirectional process leading to a commanding interface point. Bound information may have been portable, but only in pieces. Collections of information remained a commanding presence decreeing the user to come to it.

Such a tyranny of place continued to characterize the flow of information for the next half millennium. During that period multiple new information delivery vehicles were developed, all of which continued to command the user to come to them in order to enjoy the benefits. "Go to" the book was followed by "go to" the telegraph office or the telephone, "go to" the radio or television, and even "go to" a network jack in the wall. While portable devices such as a transistor radio offered the ability to receive pre-selected information, they lacked the ability to command a broad spectrum (pun intended) of information of the users' choice.

Today's networks have turned the tyranny of place inside-out. Wireless distribution of digital information to hand-held computing devices represents the first time in history that the *user* commands the information he or she needs. Mobile information retrieval empowers the user to order the delivery of whatever information he or she wants to the place where it may be most productively consumed.

Ending the tyranny of place: Leland Stanford drove in the final golden spike on May 10, 1869 to join the rails of the United States' first Transcontinental Railroad.[2]

Effect #2: Continually Increasing Speed at which Information is Transmitted and Utilized

Accompanying this reversal is the speed of the new networks. Until the 19th century the pace of life, including the speed of information, centered on the speed of man and beast. The speed and stamina of animal muscle meant that geographic distances controlled the human experience.

By overcoming the limitations of muscle power, the steam railroad crashed through pre-existing limits on human activity with ever-increasing speed and never-ending stamina. The railroad was the first high-speed network. By compressing the geographic distances that had previously isolated economic activity the railroad enabled the replacement of sub-scale production organized around the location of raw materials with the scope and scale economies of mass production. After the components of production had been inexpensively transported to a common site for fabrication at scale, they could then be redistributed to a set of newly

connected markets. Whether a city was on the network was critical to this inflow/outflow and thus critical to its economic success.

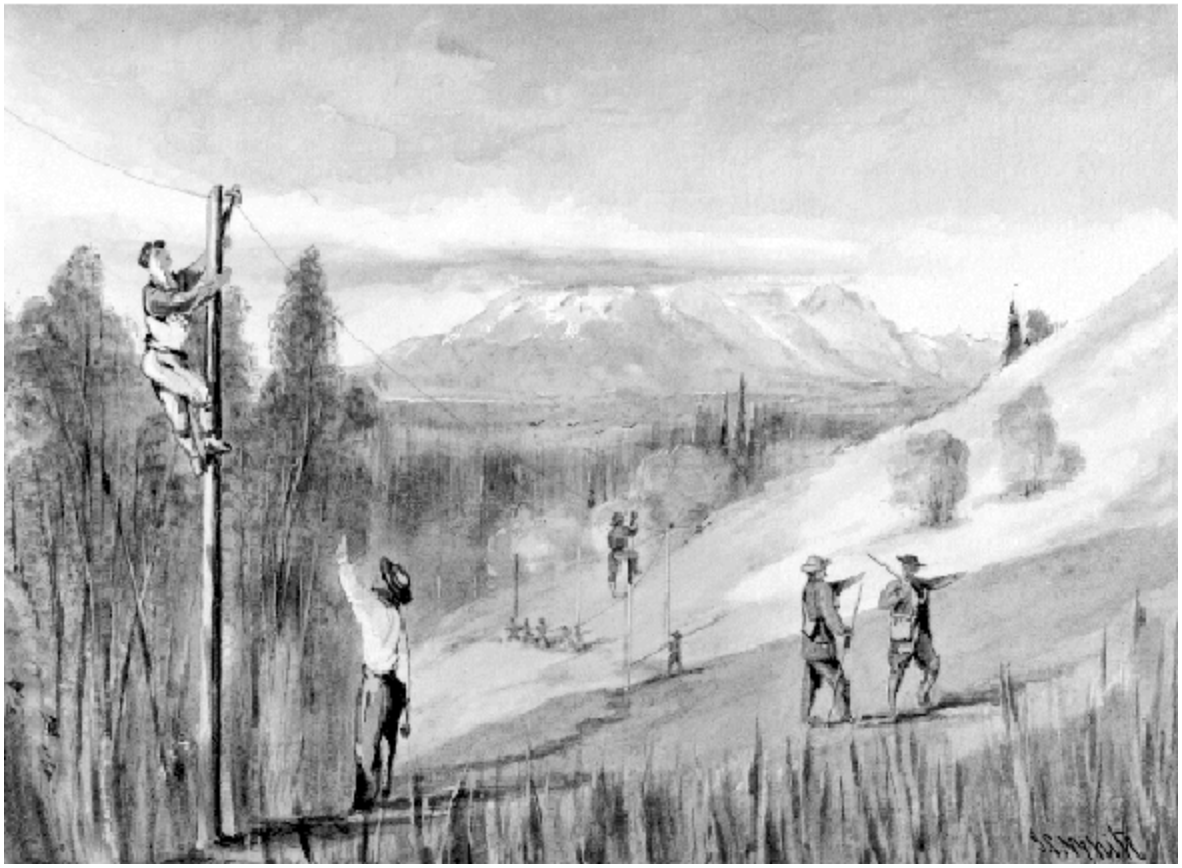
A painting of the August 28, 1830 race between a horse-drawn railroad car and Tom Thumb, the locomotive. The horse won this race, but the locomotive proved its viability.[3]

Effect #3: Decentralization of Economic and Creative Activity

The modern map of our cities is a network effect reflecting the aggregation of masses of workers at network-created common points in order to mass produce products for a mass market. The effect of today's network is to move in the opposite direction. Whereas the networks of history centralized economic activity, the new networks push such activity outward to enable small-scale yet interconnected and economically-efficient activity on a geographically

dispersed basis.‡ The networks of the 19th century destroyed individual artisans in favor of industrial production; the new networks are creating a new generation of digital artisans.

And that interconnection moves at the speed of light. When Samuel F. B. Morse tapped out "What hath God wrought" he began the third great network revolution: the separation of information from the physical delivery of its "package." The early United States created an impressive postal service but the information in a letter could travel no faster than the letter could be carried, by foot, or boat or horse. The railroad may have been the first high-speed network, but information still traveled in the physical package of a book, letter, or newspaper.



This painting depicts an ambitious (and ultimately unsuccessful) 1865-1867 project by Western Union to lay telegraph lines between San Francisco and Moscow.[4]

‡ While physical proximity remains important in areas such as Silicon Valley, it is less the function of a physical network and more the result of an ecosystem of expertise, education, capital, and the workforce. The new network, unlike the old, is not *per se* a centralizing force.

By separating information from its physical manifestation the telegraph not only removed transport time from the information equation, but it also established the concept of information as electronic signals, thus starting down the path that led to the telephone, radio and television. Ultimately, the off-and-on dots and dashes by which the telegraph conveyed information echo in the off-and-on zeroes and ones of today's binary digital code.

Our revolution is based upon abstracting information into impulses, a concept that began with the telegraph.[§] Important new networks took advantage of this third network revolution, indeed, in a real sense, the FCC was created originally to oversee the third generation networks of telephony, broadcast, and cable, until the Telecommunications Act of 1996 presciently looked forward to the next network revolution.

In other words, the printing press, railroad, and telegraph were the seminal technology-driven network revolutions of history. They established the groundwork that led to today's fourth network revolution of computing devices that communicate at high-speed across a diverse collection of interconnected networks. The earlier networks also established the *status quo* that the new networks are now disassembling.

What History Teaches Us about Networks

John Gardner once observed, "History doesn't look like history when you're living through it."[5] We know how the earlier networks changed the world. We are presently living a new network revolution that promises a similar impact on the history we leave behind.

For almost four decades I have been lucky enough to be enmeshed in the evolving interface between new networks and society. From the early days of cable television, to the digital revolution, and then cutting the cord to go wireless, I have been privileged to have a ringside seat as new networks redefined old ways. Now, as Chairman of the FCC, my colleagues and I have the responsibility of being the public's representative to the ongoing network

[§] The term "telegraph" is used broadly. The concept of messages by electronic impulses can be traced as far back as a 1753 article in *Scots* magazine.

revolution. To us falls the job President Franklin Roosevelt described as being, "a Tribune of the people, putting its engineering, accounting, and legal resources into the breach for the purpose of getting the facts and doing justice to both consumers and investors…."[6]

The acceleration of information delivery, the end of the tyranny of place, and the dispersal of economic activity is a troika of network-driven change that rattles the foundation of our commerce and culture. Nevertheless, you can put me down as an optimist when it comes to the effect the current revolution will have on the commonweal.

But I am an optimist without illusions. History teaches that while new networks create great opportunities, it is only through torment and tumult that these opportunities become manifest. The economic dislocation, ideological confrontation and uncertainty that dog us today repeat similar experiences during previous periods of network change.

The printing press helped end the Dark Ages, sparked the Reformation, and spread the Renaissance. Today we look at the Renaissance as a golden era of intellectual and social advancement. To those living through it, however, it must have seemed far from golden. The dissolution of thousands of years of tradition and perceived truth that resulted from the printed free flow of ideas produced fear, uncertainty and conflict. In one 16th century cleric's warning we hear the echoes of some of the gnashing worries raised about the changes being imposed today. "We must root out printing, or printing will root us out," the Vicar of Croydon thundered.[7]

The railroad fed the Industrial Revolution that pulled people from independent, self-sufficient agrarian lifestyles into a melting pot of workers harnessed to power mass production. Spewing soot and sparks as it cut through previously pristine fields and pastures, pulling the younger generation from their ancestral roots, the steam locomotive recast the patterns of centuries. Again, the changes were not always welcome. "We do not ride on the railroad," Henry David Thoreau complained, "it rides on us."[8]

Alongside the railroad's rights-of-way were strung the wires of the telegraph. Whereas the railroad compressed distance, the telegraph condensed time. The factor of time, which had always been a buffer to dull the sharp impact of change, became a casualty of the electronic

network. The institutions of society, built around the immutable fact that because information moved physically it moved slowly, were hit by a seismic shift to speed.

Information speeding faster than the wind meant the heretofore imponderable of weather could now be forecast. News delivered from afar at lightning speed changed the political process, forcing nations out of regional isolation and in to an interconnected whole. Electronic messages coordinated production activities, created a new managerial class, and enabled the rise of market-controlling corporations. And, as with earlier network innovations, there were dire predictions as to the result. Medical experts of the period warned that the "whirl of the railways and the pelting of telegrams" caused mental illness by placing an unnatural burden on the human body.[9]

Understanding the historical reactions to network change, we should not be surprised by a contemporary headline in *USA Today*, "Tech Tyranny Provokes Revolt." In apocryphal tones the article reported, "Technology was supposed to free us and make our lives easier, but it's done the opposite. It's creating havoc in our lives. Everyone is overwhelmed and stressed out."[10]

Opportunities Provided by New Networks

It is a false assumption that the changes imposed by our new networks should be any less tumultuous than their predecessors. At the same time, however, the new networks provide an opportunity to improve on the legacies left by those earlier networks.

Our health care system, for instance, began as the railroad brought masses of workers to a central point for mass production. Public health services such as adequate supplies of safe drinking water and institutionalized sanitation services had not been a priority in smaller towns but became a big-city necessity. The small town doc (if one was available) was a medical artisan and jack of all trades who dealt with everything from a broken foot to a cracked cranium on a sub-scale one-off basis. The tide of urbanization, however, suddenly brought scale to sickness. The solution was to apply the principles that had worked for mass production. Public hospitals

became factories for the sick where centralized services permitted specialty practices to be applied at scale.

Today, health care has never been better – or more costly. As medical success permits people to live longer it also expands the opportunities for health problems. And the most expensive way of treating those problems is in the hospital. The new networks create the opportunity to transform medical treatment from an *ex post* experience dealing with a presented problem, to an *ex ante* experience that anticipates the problem and prevents or mitigates it – all at significantly lower cost. They offer, in other words, a new combination: the bigness of scale economics with the personalization of the individual design. The power of mass production meets the individual artisan.

Sixty percent of heart failure patients, for instance, are readmitted to the hospital within six to nine months of their initial discharge.[11] The factory approach to medicine prescribes that we wait for an occurrence of the problem, then institutionalize the patients (at great cost) until they are well enough to be discharged. Because of the connectivity of our new networks, it is now possible to get in front of the problem.

My doctor is fond of talking about how medicine is an observational activity, about how the onset of medical problems can be predicted by the observation of statistically significant data inputs. Because our new networks are all about the collection and use of data inputs, they can be married with the informational nature of medicine to change the health care paradigm (even as we safeguard patient privacy).

Rather than waiting for a reoccurrence of new problems to re-hospitalize a cardiac patient, a wearable wireless device can track key indicators, constantly reporting the situation to a medical professional, to predict and preempt problems. I was recently in a meeting of about a dozen people where, unbeknownst to each other, two were wearing such devices. One person's connected with her mobile phone, while the other's with a wristwatch that then connected to the network. These individuals were able to go about their daily affairs, carrying with them the opportunity of earlier detection that allows for earlier treatment, better outcomes, and lower costs.

Examples of wearable tech used to track health factors or to communicate.[12 | 13]

The mid-19th century factory-like approach also shaped the manner in which we educate our young. Production line techniques were applied to learning. Education became a process of inputting the raw material, moving it through various processes, until 12 years later it becomes a finished product. The pedagogy of such mass production became a lecture followed by isolated individual homework in which the student tried to apply the concepts of the lecture.

The new networks allow for the old pedagogical approach to be stood on its head. The traditional model used the teacher's time to uniformly broadcast a uniform lesson to a decidedly non-uniform audience; then the student would struggle alone to apply the lesson to homework. The new networks enable another approach; the student watches the common lecture on a connected device alone and at his/her own pace. They can stop as needed to repeat something that wasn't clearly understood. Then the student comes to class where the teacher can personalize instruction based upon the student's comprehension of the lesson and where the irreplaceable stimulation of collegial discussion can be hosted.

New networks, of course, allow this new education paradigm to operate by delivering lessons to the students' connected device wherever the student may be and at whatever pace may be appropriate. The process also allows teachers to monitor the students' activity so as to be able to intervene as necessary. Studies by Carnegie Mellon University's Open Learning

Initiative have shown that such programs blending online learning with in-person instruction can dramatically reduce the time required to learn a subject while greatly increasing course completion rates.[14]

The new networks also allow for a richer in-school experience. The ability of a student in class to review a lesson on his or her tablet, or bring up a video demonstration of a topic being discussed is changing the classroom we knew. My colleague, FCC Commissioner Rosenworcel, tells the story of a school she visited in Florida where, "Students have fully traded in chalkboards and textbooks for video screens and laptops…a program that blends online learning with in-person instruction."[15]

This new educational opportunity, of course, depends on access to the new networks' capabilities. If a student cannot get access to the Internet at home the new model falls apart. When a newspaper headlines, "The Web-Deprived Study at McDonald's" because they can't afford the Internet at home and the public library is closed, but the burger joint has free Web access, something is wrong.[16]

Similarly, if students do not have access to a high-speed Internet connection at school, their learning experience is further constrained. It should be a concern to all of us that a survey of public school teachers and administrators found that 80 percent of schools participating in the FCC's eRate program reported bandwidth below the level necessary to meet their educational needs.[17]

Health care and education are but two examples of how our new networks can be put to work to solve the legacy issues of the previous networks. The challenge of energy creation and consumption along with the accompanying environmental impacts, for instance, can also be confronted with the application of data network functionality. Using telecommunications networks to increase efficiency of the power network can "build" virtual power plants that create energy through network-controlled demand management efficiencies.

Economically, networks have always been growth engines. Our new networks are no exception. Sixty-two percent of American workers rely on the Internet to perform their jobs. [18] For most of the last decade I have been engaged in the development of new businesses with

one thing in common – the harnessing of the Internet. In the process I have watched an amazing transformation take place.

In the world in which I grew up innovation and the job creation that resulted was the province of corporate development centers such as Bell Laboratories. Today the former headquarters of Bell Labs stands deserted. The innovations it pioneered have enabled the work it accomplished to be decentralized across the landscape, creating jobs, investment, and innovations on a distributed template. Never has it been easier and less expensive to develop technologically-based innovations than by exploiting high-speed connectivity and network-based cloud computing.

The opportunities presented by the new networks to attack challenges left behind by previous network revolutions are almost limitless. Our opportunity is to focus not only on the building of networks, but also on how those networks will be applied to meet our national challenges.

Resistance to Network Change

As we go about this task, the lessons of history are again informative. One such lesson is the blow-back that confronts the opportunities presented by network change. The economic incumbents threatened by the change often opposed its innovations. The other lesson is that insurgents eventually become incumbents and behave accordingly.

The printing revolution's introduction of open inquiry was a threat to the Establishment of the time. Governments and the Catholic Church both tried to shut down or curtail the new technology that was upsetting the established order. Pre-printing authorization and censorship were imposed. But the revolution continued. Yet even two centuries after Gutenberg's great breakthrough, the Establishment was still fighting back. Books, it was warned, "will make the following centuries fall into a state as barbarous as that of the centuries that followed the fall of the Roman Empire."[19]

The iron horse's ability to span great distances at high speed threatened the livelihood of those whose business was based on slower realities. As one historian noted, "Every ploy known to shrewd local lawyers was used to keep things nice and cozy for local carting companies, freight forwarders, hack drivers, hotel and restaurant owners, local wholesale merchants, and anyone else" for whom the railroad represented a change from the *status quo.*[20] When legal means failed, vigilantes tore up at night the track that had been laid during the day. Legislatures passed laws restricting the ability of the new network to compete with the old.

Hanging on my office wall at the FCC is an 1839 poster printed by those opposed to the interconnection of two rail lines. The sign says nothing about its sponsors or their desire to protect their businesses of hauling people and freight between the disconnected lines or selling food and sundries to those in transit. Instead, the connection was portrayed as a dire threat to public safety – especially women and children. "MOTHERS LOOK OUT FOR YOUR CHILDREN" the poster blares accompanied by an image of ladies scurrying to safety to avoid a rampaging engine.[21]

1839 poster opposing interconnection of Philadelphia rail lines.[22]

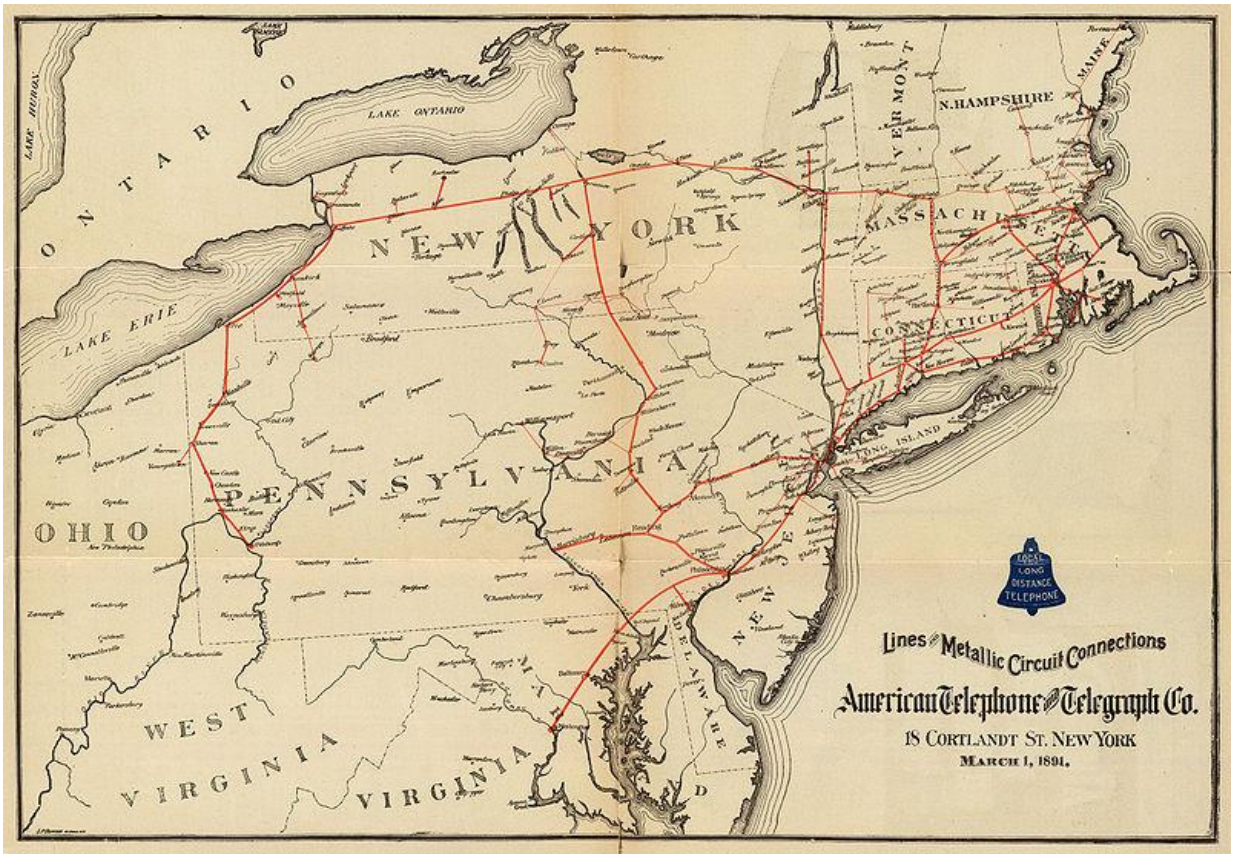
From Insurgent to Incumbent

The history of the railroad network also illustrates what happens when the insurgent becomes the market-dominating incumbent. Because small agricultural communities rarely had more than one rail line, for instance, that company was able to extract what economists call "monopoly rents." Rates were higher than would have been charged in a competitive market. The rates charged small town farmers to move their produce a short distance to a trading center, for instance, were often twice the rate charged for a longer run on a competitive line.

In 1887 pressure from these farmers resulted in the creation of the Interstate Commerce Commission (ICC). The mandate of the ICC was to apply offsetting government power against the power of the railroads so as to assure the protection of the network's users.

It was the first independent Federal regulatory agency and the template for all that was to follow.[23]

The evolution from insurgent to incumbent was also the path followed by the telephone network. As the Bell Telephone Company tried to build upon the technology developed by its namesake, the mighty Western Union Telegraph Company, which had also gone into the telephone business, exploited its market position to block Bell. By the end of 1878 Western Union had almost six times the number of telephone subscribers as did Bell.



This 1891 map sketches out the initial lines making up AT&T's early network. The cover of the map states the following: "500 miles and return in 5 minutes. The mail is quick; telegraph is quicker; but Long Distance Telephone is Instantaneous and you don't have to wait for an answer."[24]

At the Bell battlements fighting the ever-expanding telegraph/telephone colossus stood Theodore Vail. Railing against the larger company's market power, Vail was the classic

insurgent. Eventually, and amazingly, however, Jonah swallowed the whale by buying Western Union's telephone assets. When Vail's market position changed, so did his approach.[25]

As president of AT&T, Vail imposed policies he had previously fought. "Two exchange systems in the same community…cannot be conceived of as a permancy," he wrote in the 1907 annual report. "Duplication of charges is a waste to the user." It was the concept of a "natural monopoly," that for such a capital-intensive business the only efficient solution was a single provider. To further this vision Vail began to buy up independent telephone companies across the United States. He leveraged AT&T's market power to assist his expansion. If a company resisted selling it would suddenly discover difficulty interconnecting with AT&T's long distance lines.

In a 1913 agreement with the Federal government, Theodore Vail codified the natural monopoly concept in return for, among other things, a requirement that other telephone companies must be allowed to interconnect with AT&T's long distance network. It was the beginning of the regulated monopoly that would go on to define telecommunications service for most of the 20th century.

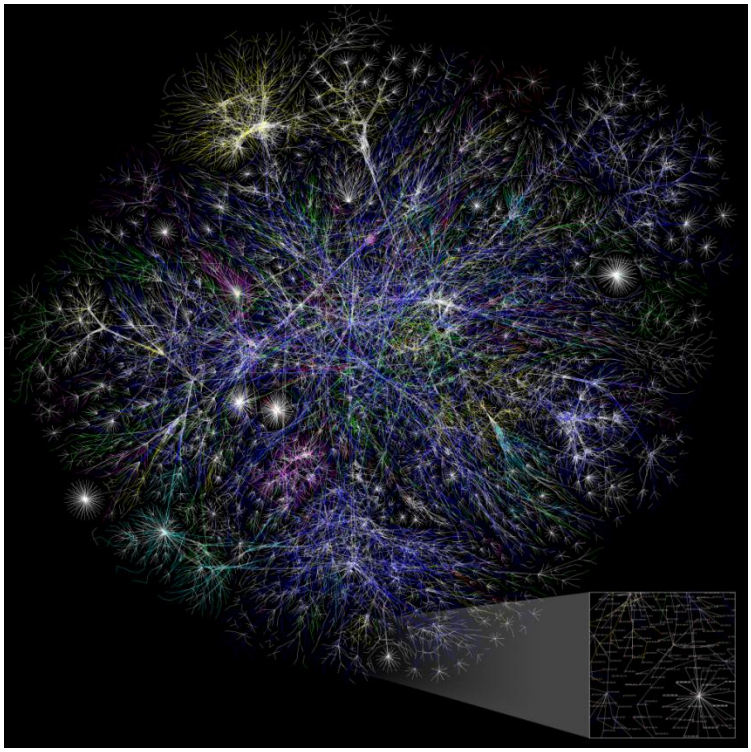
The Evolving Regulatory Model for Networks

The network revolution through which we are living has produced a marketplace far different from that which we knew in the 20th century. As we live the history of these changes we are also living the evolution of the regulatory model that developed around the realities of the 20th century. There are some who suggest that the new technology should free the new networks from regulation. While the elimination of circuit-switched monopoly markets certainly obviates the need for the old monopoly-based regulation of that technology, one can also argue that the new networks are even more important to society than were the old ones and that the public has the right to be represented in the change equation.

How we deal with these issues has never been more important because of one other network effect. The importance of the basic network has always come from how it enables

other networks to exist. The railroad, for instance, enabled networks for the delivery of parcels and mail order retail as well as the refrigerated delivery of food that substantially reduced prices and put meat on tables. The telegraph enabled the establishment of news networks and financial networks. These were substantial network effects; but today's networks are even more critical in their effects.

Information delivery networks *are* the new economy. Our networks have never been more integral to our well-being. The industrial economy has been replaced by the information economy that is predicated on the operation of information networks. Economic growth, attacking the legacy problems of the old networks, and building on the new opportunities of high-speed data are all dependent upon the core telecommunications networks. From health care, to education, to the new apps on your mobile device, the growth networks of our economy rely on the performance of core information networks.



A visualization of the early 2005 internet. Note that green lines represent .com and .org and blue lines represent .net, .ca, and .us.[26]

Three Pillars to Communications Policy

The result of such network reliance is what makes the work of the FCC so interesting and important. Like the rest of society, the Commission must deal with legacy issues as well as plan for the future. The FCC's role must be inextricably tied to the dual responsibilities of *facilitating* the dynamic technological change that will persevere long after we are gone, and to *protecting* and extending forward in time the enduring civic values that successful networks have historically embodied.

There are three pillars to communications policy that guide that process: promoting growth, preserving the fundamental arrangements that I call the "Network Compact," and safeguarding the broader values historically associated with communications policy.

Pillar #1: Promoting Economic Growth and National Leadership

The first is that policy should promote economic growth and national leadership. A seminal legacy issue is that our current networks each grew up in different environments. Those different histories affect how these networks plug into the new future, including the role of government. The wired networks – whether telephone companies or cable companies – grew out of 20th century monopolies. Typically, there was only one telephone company and one cable company in a town. Contrast that with how from the start there have been multiple wireless networks. The Communications Act's policy goal for all networks is to ensure reasonably priced, world-class services for all Americans. Because competitive markets are more nimble than the regulatory process, the goal should be to ask how competition can best serve the public – and what, if any, action (including governmental action) is needed to preserve the future of network competition in wired networks or wireless networks.

In a competitive market the speed, price, capacity, quality and choice of network services should show constant improvement. Policies that encourage new investment, competitive offerings and protect markets from unwarranted consolidation also increase the "home field advantage" for American companies. One of America's historical advantages in the

world economy has been a large internal market. Such an advantage was the bedrock of American leadership in the industrial era and must not be lost in the information era. The quality and scale of our country's telecom networks gave us the pole position in the information economy. Maintaining that competitive advantage is a national priority. The Internet began in the U.S. because government encouraged it and our networks permitted it; squandering that advantage would be a national calamity.

Pillar #2: Guaranteeing the Network Compact

Beyond such structural issues is the basic relationship between networks and those they serve. The technology that drives the new networks may have changed their design and operation, but the essential components of the relationship between the network and its users has not changed.

The second policy pillar, therefore, is the Network Compact between those who provide the pathways and those who use them. This civil bond between networks and users has always had three components: access, interconnection, and the encouragement and enablement of the public-purpose benefits of our networks (including public safety and national security).

The inability to access a network is like the proverbial tree falling in the forest. If you can't access networks, they might as well not exist. There are several manifestations of network access, all of which are topics of the Communications Act. One component of access is universal service. If high-speed Internet connections have not been built to an area or are denied to individuals because of either their individual economic realities or the practices of the provider, then access has been effectively denied. For example, rural communities that don't have access to our new networks cannot fully participate in our economy and our culture. Similarly, if someone has a desire to use the network but is thwarted by unreasonable network practices, then access has been denied. And if when using a network basic consumer rights and the rights of people with disabilities are violated, then the right of access has also been violated.

Interconnection is, of course, tied linguistically to the "Internet", which is short for the original name "internetworking." The Internet is the stitching together of often disparate networks through the use of a common protocol (TCP/IP). The Internet is not a network, *per se,* but a collection of networks harnessed to a common purpose. As such, the value of the Internet has always been its "Inter" – as in the **inter**connection and **inter**operability of these disparate networks. As a collection of networks over which information packets travel in seemingly random paths, the Internet is not like the telephone network's dedicated circuits. Twentieth century telephone regulation focused on dealing with the effects of the switched circuit monopoly. Telecommunications oversight today should focus on encouraging and protecting the unique capabilities of the components of the Internet. The telephone network created an identifiable, singular, end-to-end path. The Internet is far different; it is a collection, not a thing. As such the interconnection of the parts of the collective we call the Internet is a *sine qua non.*

We must be clear. "Regulating the Internet" is a non-starter. What the Internet does is an activity in which policy makers should not be involved (other than assuring overriding purposes such as the ability to complete 911 calls or the ban of child pornography). Regulating Internet access is a different matter. Assuring the Internet exists as a collection of open, interconnected facilities is an appropriate activity for the People's representatives.

The final component of the Network Compact is the responsibility to protect national security and public safety. The packet-switching technology of the Internet was developed to enhance U.S. national security by making it difficult for an enemy to destroy the ability of the United States to order a retaliatory strike.[**] Today, the technology designed to enhance national security has become the pathway by which those who would do us ill – ranging from criminal gangs to state actors – can access the very essence of our economic, individual, and military well-being. Our networks must be secure. At the same time, our networks must continue to be the safety backbone during individual or mass emergencies. The ability to

[**] It is an urban legend that the Internet and its predecessor, ARPANET, were developed as a means by which communications could survive a nuclear attack. It is factual, however, that Paul Baran developed the concept of packet switching (upon which the Internet relies) while working at RAND Corporation on a U.S. Government contract to develop a means to make networks capable of surviving a first strike.

summon emergency help, to coordinate emergency response, and to do so via a network that is as secure as possible from cyber-attacks must be unquestionable.

Pillar #3: Enabling the Public Purpose Benefits of Networks

The third policy pillar is the encouragement and enablement of the public purpose benefits of our networks. Broadband for the sake of broadband is an empty goal. As we have seen, the importance of networks is not the technology itself, but what the technology enables. Out of the first two policy pillars comes an accessible, usable network. The third pillar's purpose is to apply that for the delivery of public benefits. Included in such a list of public benefits must be the provision of the tools necessary for a 21st century education, access to the benefits of the new networks by individuals with disabilities, and the maintenance of diversity, localism, and free speech. As history has taught, the importance of networks is not what they are, but what they enable.

The Communications Act is quite specific that the role of the FCC is to protect "the public interest, convenience and necessity." This mandate traces to the creation of the Federal Radio Commission in 1927, was incorporated into the Communications Act of 1934, and was reaffirmed by Congress in 1996. For almost 90 years this instruction has been the alpha and omega of the government's responsibility and authority. As technologies have changed and markets have evolved it has remained inviolate. The challenge of the FCC today is the delivery on this mandate – which continues in law and must continue in practice – in a manner that supports this third pillar, enabling the public purpose benefits of our networks.

Eugene Octave Sykes (seated bottom left) served as the first Chairman of the FCC from 1934-1935.[27]

The Relationship between Competition and Regulation

Let's begin with the fact that a dynamic market deserves dynamic decision making. It took the FCC 15 years after its 1968 decision to dust off a 10-year old petition for mobile telephony spectrum before the implementation of the first cellular service in Chicago. During that time Americans watched as countries around the world rolled out mobile services to their citizens. Not only was the process slow, but also the Commission had a "we know best" attitude that was exemplified by Commissioner (later Chairman) Robert E. Lee's warning that people calling each other on cellphones was "frivolously using spectrum."[28]

However slow and debilitating the FCC's decision making on cellular service was, it was not just the harbinger of the untethered era, but also of the competitive era. When it finally got around to allocating spectrum, the government got it right; there would be two competitors in each geographic area – and more over time. In an era when there was The Telephone Company, the FCC broke with precedent and created a competitive wireless marketplace. Thirty years later, the regulatory mission of the FCC continues to be informed by those watershed

precedents: delay is the enemy of innovation, and competition is the lifeblood (or *sine qua non*) of growth and innovation.

These lessons manifest themselves in a few regulatory concepts.

There should be an inverse relationship between competition and government action. The more there is of the former, the less there need be of the latter. The old monopoly model began with the assumption that telecommunications was a "natural monopoly" sanctioned by the government and overseen in great detail by that government. When there is effective competition there is less need for the government to substitute for it.

Viable competition among networks is essential, and the networks must remain competitive. Competition must be encouraged, facilitated, and where present protected. The response to those who complain about "regulatory burden" is the embrace of effective competition.

Yet, workable competition sometimes is not attainable, and even where it is theoretically possible, it is not the most natural of economic acts in the marketplace. Capital markets and investors worry that higher profits do not always come from the price discipline of rigorous competition. Appropriately celebrated for its benefits, economic forces nonetheless naturally connive to limit competition. Over the years I have repeatedly heard business leaders comment, "We welcome competition." They are sincere in these statements, but there is a difference between celebrating the concept of competition and aggressively seeking its implementation. The real world business environment inherently attracts anti-competitive antibodies seeking to immunize markets from its effects.

The role of the FCC is to both protect and stimulate competition in order to provide consumers access to world class networks on reasonable terms. If the goal of the providers of telecommunications services is to avoid regulation, then the path to that end is clear: effective competition in the present and an effective path to competition in the future. Where markets fail or are threatened, the FCC has the responsibility to provide redress.

The Role of Multi-Stakeholder Processes

In a world of fast-paced technological innovation there is also a legitimate reason to investigate whether the process that facilitates such rapid innovation can be applied to the process of government. One of these models is the use of multi-stakeholder coordination that brings together all the affected players for the purpose of developing a common solution and then enforces its implementation. Another is a simple precept: successful businesses learn continuously; so must government. The multi-stakeholder approach with its ethic of inclusivity has many attractive features and potential benefits, but they must be produced efficiently – that is, quickly – in the context of the rapid change in which we find ourselves.

Where the multi-stakeholder model exists, speed, learning, and flexibility should be rewarded where it serves the "public interest, convenience and necessity," as a valuable addition to the Commission's tools. The FCC can identify specific goals and work with the stakeholders to develop a meaningful process. This should not be confused, however, with a "Regulation Free Zone." The FCC can identify the issues that lend themselves to multi-stakeholder solutions within the agency's responsibility, provide the convening function, and coordinate the process. Most importantly, however, the result must be more than words on paper. "If you will, we won't" is a good regulatory philosophy for the era of fast-paced technological innovation. However, it only works when accompanied by serious oversight and an iron-clad corollary: "But if you don't, we shall."

The FCC recently had an experience with just how voluntary standards can be ignored. The Network Compact of providing for the public's safety was violated when the self-regulation associated with the provision of backup 911 services was ignored by some companies, only to be exposed during an emergency. A wise man once taught me to "inspect what you expect." The regulatory agency should encourage multi-stakeholder solutions to network responsibilities which include strong oversight to assure the delivery on the promises and a rapid regulatory response if the promises are not fulfilled.

The Need for Expeditious, Fact-Based Policymaking

A similar demand for dispatch should apply to the agency's regulatory activities. The regulatory processes of the FCC have been criticized by some as being too opaque and cumbersome. At the same time, however, this is the agency that moved expeditiously after being given spectrum auction authority in 1993 and with similar dispatch to meet all the deadlines in the implementation of the 1996 Telecommunications Act. Investigating how the agency can operate quickly and smoothly under the procedural requirements of the Administrative Procedure Act (APA) should be a priority.

One key component of the FCC's administrative process is to focus like a laser on a fact-based, data-driven process. The goal of the agency's rulemakings should be to begin with a rebuttable presumption and invite submission for the record of data that either supports or refutes the proposition. It is a simple, yet powerful concept that should be the FCC's North Star; facts evidenced by supporting data.

* * *

The network revolutions of history have led us to our moment of history, a hinge moment when the definitive activity of how we connect is being redesigned. In the coming months we will lay out in greater granularity how this history and these principles apply to the responsibilities of the FCC. The history of other such moments when networks redefined the human experience teaches us that while such periods are full of tumult, they are even more full of opportunity. To our generation has been passed the privilege of participating in an historic moment. To those of us charged with being the public's representative to the revolution falls the responsibility to maintain incentives to expand and garner the value of the present and future electronic networks while protecting the enduring values networks provide the people they serve.

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[1] "Press1520," 1520, PD-1923, retrieved at http://commons.wikimedia.org/wiki/File:Press1520.png

[2] Architect of the Capitol, "Golden Spike," 1993-1994, PD-USGov-POTUS, retrieved at http://commons.wikimedia.org/wiki/File:Flickr_-_USCapitol_-_Golden_Spike.jpg

[3] Carl Rakeman, U.S. Department of Transportation, "1830 - The Iron Horse Wins," PD-USGov-DOT, retrieved at http://www.fhwa.dot.gov/rakeman/1830.htm

[4] John Clayton White, "Collins Overland Telegraph," PD-1923, retrieved at http://en.wikipedia.org/wiki/File:Collins_Overland_Telegraph.gif

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[9] Albutt Cliffors, "Nervous Diseases and Modern Life," *Contemporary Review,* 1895. See also http://jama.ama-assn.org/cgi/content/full/290/117/2327

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[12] "White Fitbit Zip" by Steven Walling is licensed under CC BY-SA 3.0

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[19] Ann Blair, "Reading Strategies for Coping with Information Overload ca 1550-1700," *The Journal of the History of Ideas,* 64, no. 1, p. 1, quoting French scholar Adrien Baillet in 1685

[20] Albro Martin, *Railroads Triumphant*, Oxford University Press, 1992. P. 49

[21] National Archives, www.archives.gov/education/lessons/anti-rail/images/propaganda-poster.gif

[22] "Mothers Look Out For Your Children," 1839, PD-1923, retrieved from author's personal collection.

[23] Early telecommunications was added to the ICC's jurisdiction in 1910. The Federal Communications Commission (FCC), created in 1934, was conceived along the lines of the ICC to take over the agency's telecommunications authority as well as that of the Federal Radio Commission (FRC).

[24] "Lines and Metallic Circuit Connections, American Telephone and Telegraph Co, March 1, 1891," 1891, PD-1923, retrieved at http://commons.wikimedia.org/wiki/File:Lines_and_Metallic_Circuit_Connections,_American_Telephone_and_Telegraph_Co,_March_1,_1891_edit.jpg

[25] There was a break in Vail's service between 1887 and 1902. In 1907 he became CEO of AT&T

[26] "Internet map 4096" by The Opte Project is licensed under CC BY 2.5

[27] Harris-Ewing collection, "Federal Communications Commission 1937 10 6," 1937, PD-1923, retrieved at http://commons.wikimedia.org/wiki/File:Federal_Communications_Commission_1937_10_6.jpg

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